covering, the matter is quite different. The more the atmosphere emits (absorbs) the more does the sun's radiation pass in this roundabout way to the higher latitudes, to a large extent in winter but to a less extent in the whole year. In summer its heat conservation is negative, but in winter we benefit from solar radiation which is conveyed to the higher latitudes in a roundabout way by atmospheric radiation. The fact that the "radiation temperature" of central Europe is increased to the extent of 30 to 60 degrees (C.) by the counter radiation of the atmosphere shows that the atmosphere has not received its great capacity for radiating by being irradiated in these latitudes. The general circulation of the atmosphere—which is particularly active in winter on account of the large temperature differences—brings into higher latitudes masses of air capable of radiating and furnished with great quantities of entropy in the equatorial regions. The general circulation may be compared with a huge föhn, which ascends in the tropical belt of calm, flows over the trade-wind region and the horse latitudes and in descending is capable of radiating profusely on account of the high potential temperatures at moderate water vapor content.

In order to decide whether heat is conveyed to the higher latitudes and land masses chiefly only by solar radiation and atmospheric radiation, we have still to take into account the influence of the process of condensation. If water vapor condenses, quantities of entropy become available so that work and the yielding of heat can be combated. If the performance of work is sufficiently small, then in case the condensation takes place at 0°, the yield of heat is about 600 $\frac{\text{gram cal}}{\text{gram}}$ (at −10°, 0°, +10°, it is 613, 607, and 589 cal., respectively). If we take a yearly rainfall of 120 cm, the condensation provides daily about 200 $\frac{\text{gram cal,}}{\text{cm}^2}$ while the counter radiation of the atmosphere is about three times this quantity. Now, Brückner [14] has shown that each drop of rain falls to the ground, on the average, three times before it is again returned to the ocean, consequently two-thirds of the heat made available by condensation is taken up from the land in evaporation. With a yearly rainfall of 120 cm, the quantity of heat brought by the water vapor taken from the ocean and made available by condensation is only 67 $\frac{\text{gram cal,}}{\text{cm}^2\text{, 24 hrs}}$ thus about 10 per cent of the counter radiation of the atmosphere, while over the ocean itself, the ratio is smaller. The gain of heat from condensing water vapor is small compared with the gain by radiation from radiating masses of air warmed in tropical regions.

The investigations of this paragraph were founded on a constant average content of water vapor in the atmosphere. The absorption capacity of the atmosphere as a function of the humidity is far too scantily known for us to be able to take into account with any certainty the variability of the humidity with regard to place and time. This quantity which is of such importance for the conservation of the earth's heat can be obtained by systematic measurements of the counter radiation of the atmosphere by means of the theory developed here.

[14] *Brückner, E.* On the origin of rain. Geographische Zeitschrift, 1900, 2:89.

A TORNADO IN UTAH.

By ARTHUR W. STEVENS, United States Forest Service.

[The following report is transmitted through A. H. Thiessen, meteorologist, Salt Lake City, Utah, who remarks that the phenomenon is so very unusual in Utah that more than ordinary interest attaches to it.]

A small tornado occurred to-day (August 5, 1916) in the valley of the East Fork of the Sevier River about 1 mile north of Dave's Hollow ranger station, elevation 7,800 feet.

As observed from the station, the tornado appeared to have formed a short distance east of Frank Hatch's ranch on the Tropic Road. When first observed it was in the form of a slender inverted cone. It was too far distant to observe any whirling motion, but small puffs of cloud-like smoke were traveling rapidly upward on the outer surface of the cone.

The cone elongated rapidly and took on the shape of a rat's tail. The tip of the cloud did not touch the ground at any time, but directly under it was a large whirlwind that lifted a spray of mud and water from the ground.

The whirling cloud was white and at times appeared almost luminous, probably by contrast with the exceedingly dark cloud back of it.

The tornado lasted about 15 minutes, and traveled not over one-half mile in an easterly direction before breaking up.

After the storm I rode over the area of the storm, but as the only vegetation was sage brush and similar plants not over a foot high, there was no evidence to show exactly where the tornado had passed. The strip of ground affected was probably not over 20 or 25 feet wide, and possibly narrower than that.

This occurred during a period of exceptionally violent local rain and thunderstorms. Ranger Houston, of Dave's Hollow, pronounced it a waterspout, and I think it was so entered in his weather report for the day; but it was undoubtedly the same as the "twisters" of the Middle West, and the occurrence of one west of the Rockies was thought to be sufficiently rare to be worth recording.

THE GOVERNMENT SAFETY-FIRST TRAIN, 1916.

By RUY H. FINCH, observer in charge of Weather Bureau Exhibit.

[Dated Weather Bureau, Washington, Sept. 25, 1916.]

During the summer of 1916 a unique method was pursued in informing the public as to some of the work that is being done by the various branches of the Federal Government.

While a great many people have had an opportunity to visit the different international expositions, and the National Capital, yet the vast majority of our citizens have but little knowledge of Federal activities.

After the Safety-First Convention, held in the New National Museum where most of the departments of the Government had exhibits, the idea was conceived of placing the exhibits on a railway train and giving everyone an opportunity to see what the Government is doing in the way of safeguarding life and property. Accordingly, a selection of exhibits was made and placed in 10 steel coaches, from which the seats had been removed, of the Baltimore & Ohio Railroad. Thus the Government Safety-First Train, a "World's Fair on wheels," originated, and on May 1, 1916, it started on its four months' educational trip.

The exhibits were arranged on both sides of the cars, or so as to leave a passageway from one end to the other,